AI Enabled MED Drone for Healthcare Application

Hemalatha D
UG Scholar, Department of Medical Electronics,
Sengunthar College of Engineering, Tamil Nadu, India
hemalathadhanasekar78@gmail.com
Dharshini S
UG Scholar, Department of Medical Electronics,
Sengunthar College of Engineering, Tamil Nadu, India
dharshinisp710@gmail.com
Ramesh P
UG Scholar, Department of Medical Electronics,
Sengunthar College of Engineering, Tamil Nadu, India
rameshtamilv05@gmail.com
Priya.S
Assistant Professor, Department of Medical Electronics,
Sengunthar College of Engineering, Tamil Nadu, India
spriya.mee@scteng.co.in

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Abstract: The project proposes the development of an AI-enabled MedDrone for medication delivery, introducing an innovative and efficient solution to enhance healthcare logistics. The MedDrone, equipped with artificial intelligence capabilities, aims to revolutionize the process of medication delivery by leveraging autonomous aerial technology. The system integrates advanced algorithms to optimize route planning, ensuring timely and accurate delivery of medications to designated locations. The AI component enables the drone to adapt to real-time variables such as weather conditions and traffic, enhancing the reliability and responsiveness of the delivery process. This project addresses the challenges of traditional medication distribution, offering a futuristic and intelligent approach to healthcare logistics through the deployment of AI-enabled autonomous drones for efficient and timely medication delivery. The proposed system integrates AI algorithms for real-time route optimization, obstacle avoidance, and decision-making, enabling the drone to autonomously navigate complex environments and deliver essential medical supplies such as first aid kits, defibrillators, and medications to the point of need. Through the utilization of machine learning techniques, the drone continuously learns from its interactions with the environment, enhancing its adaptability and performance over time. Additionally, the system incorporates advanced communication technologies to enable seamless coordination with emergency responders and healthcare professionals, ensuring timely delivery and proper utilization of resources. The efficacy of the proposed AI-based medical drone system is demonstrated through simulations and real-world trials, highlighting its potential to revolutionize emergency response efforts and improve healthcare accessibility, particularly in challenging or resource-constrained environments.
Keywords: Med Drone, AI, Healthcare, Emergency.

I. INTRODUCTION

Drones, a common term in this modern technologically advanced & growing world has been a great invention and has been proven of great use in the last decade. We have seen its implementation in different areas like the military organizations in order to patrol dangerous areas to monitor for any potential threat or illegitimate activities. It is of great use when it comes to provide efficient and convenient surveillance. We have seen drones applications in farming equipment where it is used to spread medicines in the organic fields, carry out easy and safe pesticides disposal over the crops. In the same manner we have developed a drone which is able to deliver essential and vital medicines in the areas where proper transportation is not available for the native people. This drone is capable of delivering the medicine to the places where it cannot be transported using any mechanical vehicle commonly used by all delivery agencies. In any pandemic situation where human interaction are not advised and social distancing is the key in health management structure, this Unmanned drone medicine delivery system can be used as a strong weapon to fight against the pandemic.

In emergency situations where the present transportation structure is shattered due to flood earthquake etc. this type of automatic drone delivery system can save precious lives with much less and nominal efforts. Not only in the rural areas but also in fully developed cities this project can be of great use. The developed and fast moving cities are majorly bothered with slow moving traffic jams. In India, there are many cases reported where the late delivery of medicines to any health organization proved to be very fatal, therefore this drone delivery project will come handy in case of efficient delivery of medicine in the cities where traffic congestion and bad conditions of road become a major drawback in all the above mentioned situations.

II. PROPOSED MODEL FOR MED DRONE

A. ELECTRIC AND ELECTRONIC COMPONENTS

The flight controller is essentially the brain of a drone, responsible for managing its flight operations. The flight controller then sends commands to the drone's motors to adjust thrust and orientation, allowing it to hover, maneuver, and navigate according to the pilot's inputs or autonomous instructions. The purpose of a BLDC motor in a drone is to generate the thrust required for flight by spinning the propellers. Ultrasonic sensors are commonly used in drones for various purposes, primarily related to navigation and obstacle avoidance. Ultrasonic sensors emit high-frequency sound waves and measure the time it takes for these waves to bounce back after hitting an obstacle. By analyzing this data, drones can detect nearby objects and take evasive action to avoid collisions, helping to prevent accidents and damage to the drone. Ultrasonic sensors to assist in landing accurately. ESP32 camera module in a drone is possible and can be a cost-effective solution for capturing images or video during flight. The ESP32 camera module with the drone's flight controller and power supply, as well as develop or utilize existing firmware to control the camera and transmit the images or video feed wireless to a ground station or receiver

Fig.1. Flight Controller

Fig.2. ESP 32 Camera

Fig.3.Ultrasonic sensor

Fig.4.BLDC Motor

III. MED DRONE PHYSICAL STRUCTURE

The battery is a critical component of AI-enabled MedDrones for medication delivery, providing the necessary power to drive the drone's propulsion system, onboard electronics, and AI algorithms. The controller component of AI-enabled MedDrones for medication delivery serves as the central interface for managing and orchestrating drone operations with precision and efficiency. Its primary objective is to enable seamless communication and controlbetween ground operators and the drone, ensuring safe and reliable flight performance throughout medication delivery missions. The drone, as an integral component of AI-enabled MedDrones for medication delivery, serves the primary objective of efficiently transporting essential medications and medical supplies to patients in need. Equipped with advanced navigation systems, payload compartments, and autonomous flight capabilities, the drone aims to overcome logistical challenges and ensure timely delivery of medications to remote or inaccessible areas.

Wireless data transfer in AI-enabled MedDrones for medication delivery comprises several components, including antennas, transceivers, and communication protocols. Antennas receive and transmit radio frequency signals, while transceivers modulate and demodulate these signals for data transmission. Communication protocols, such as Wi-Fi, cellular, or satellite communication, facilitate the exchange of data between the drone and ground stations or control centers. The video record system in AI-enabled MedDrones for medication delivery consists of cameras, storage devices, and video processing units. Cameras capture high-resolution video footage of the drone's surroundings during flight. Storage devices, such asonboard memory or removable SD cards, store recorded video data for later analysis or review. Video processing units process and compress video data in real-time, ensuring efficient storage and transmission of recorded footage.

The weight lifting machine in AI-enabled MedDrones for medication delivery consists of motors, mechanical linkages, and lifting mechanisms. Motors provide the necessary torque and power to lift and lower payloads, such as medication packages, during delivery operations. Motors act as the driving force behind the weight lifting machine, converting electrical energy into mechanical motion to liftand lower payloads. Mechanical linkages transmit motion from the motors to the lifting mechanisms, ensuring smooth and controlled movement of the payload. Lifting mechanisms are designed to securely hold and release payloads, allowing for precise positioning and delivery during flight operations. The alert system in AI-enabled MedDrones for medication delivery consists of sensors, communication modules, and alarm mechanisms.

Sensors detect potential hazards or anomalies during flight, such as obstacles, adverse weather conditions, or equipment malfunctions. Communication modules enable the drone to transmit alert signals to ground control stations or nearby personnel in real- time. Alarm mechanisms, such as visual indicators or audible alarms, alert operators or bystanders to critical events requiring attention orintervention.

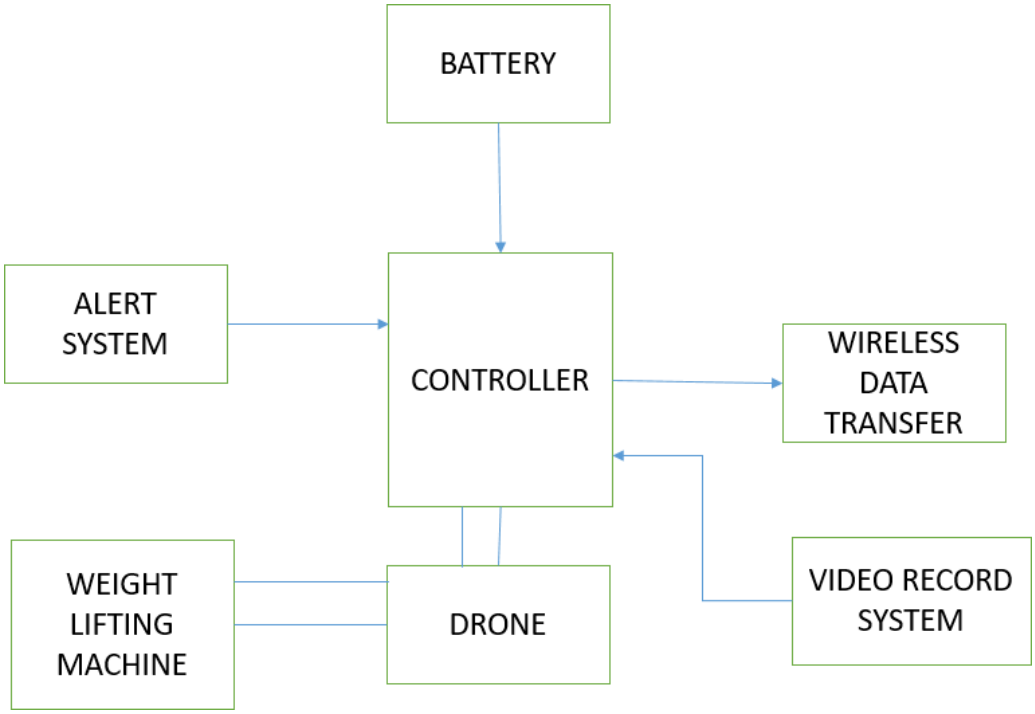

Fig.5.Block Diagram of Proposed Model

IV. METHODOLOGY

To develop a medication delivery drone with an object detection system and recording capability, the methodology involves several key steps. Firstly, select suitable hardware components such as a drone platform capable of carrying medication payloads and integrating cameras for object detection and recording. Opt for BLDC motors to enhance flight efficiency and reduce costs. Next, implement computer vision algorithms for real-time object detection, training the model to identify obstacles along the drone's flight path. Integrate this system with the drone's control interface to trigger alert s and alarms upon detection of obstacles. Develop a recording functionality to capture flight data and encountered obstacles for post-flight analysis. Conduct extensive flight testing to validate the performance of the object detection system, alert mechanism, and overall drone operation. Optimize flight dynamics and motor control algorithms for efficient and safe flight. Ensure compliance with relevant regulatory standards for drone operations and medical delivery. Continuously gather feedback for iterative improvements in performance, reliability, and user experience. Through these steps, a robust medication delivery drone with advanced object detection and recording capabilities can be successfully developed.

Fig.6. Proposed Model

V. FUTURE SCOPE

The development and implementation of AI-enabled MedDrones for medication delivery mark a transformative step forward in healthcare logistics. These unmanned aerial vehicles, powered by sophisticated artificial intelligence algorithms, offer unprecedented capabilities in delivering essential medications to patients in a variety of settings. By autonomously navigating through challenging environments, optimizing delivery routes, and adapting to dynamic conditions, AI-enabled MedDrones can significantly improve the efficiency and reliability of medication delivery, particularly in remote or underserved areas where access to healthcare facilities may be limited. The integration of AI technology into MedDrones not only streamlines the delivery process but also enhances patient care by ensuring timely access to vital medications. With the ability to overcome traditional logistical constraints such as traffic congestion or geographical barriers, AI-enabled MedDrones have the potential to revolutionize healthcare delivery, enabling faster response times during emergencies and improving overall healthcare outcomes. Moreover, the scalability and versatility of MedDrones make them well- suited for a wide range of applications beyond medication delivery, including medical supply transportation, disaster relief operations, and aerial surveillance for public health monitoring. As we continue to witness advancements in drone technology, artificial intelligence, and healthcare innovation, the future of AI-enabled MedDrones holds immense promise for reshaping the landscape of healthcare delivery. With ongoing research, development, and collaboration between industry stakeholders, regulatory bodies, and healthcare providers, AI-enabled MedDrones have the potential to become integral components of healthcare systems worldwide, bridging gaps in access, improving patient outcomes, and ultimately saving lives.

VI. CONCLUSION

In conclusion, the project on the "AI-enabled Med Drone for Medication Delivery" holds great promise for revolutionizing healthcare logistics. By integrating artificial intelligence into drone technology, the system addresses the limitations of traditional medication delivery methods, offering a more responsive, efficient, and adaptable solution. The autonomous capabilities of the MedDrone, coupled with AI-driven route optimization, ensure timely and precise delivery of medications, particularly in challenging or time-sensitive situations. This technology not only enhances the speed of medication distribution but also has the potential to reach remote or inaccessible areas, improving healthcare accessibility on a broader scale. The AI-enabled MedDrone represents a significant step towards transforming medication delivery services, showcasing the potential for innovative technologies to positively impact healthcare systems and patient outcomes.

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